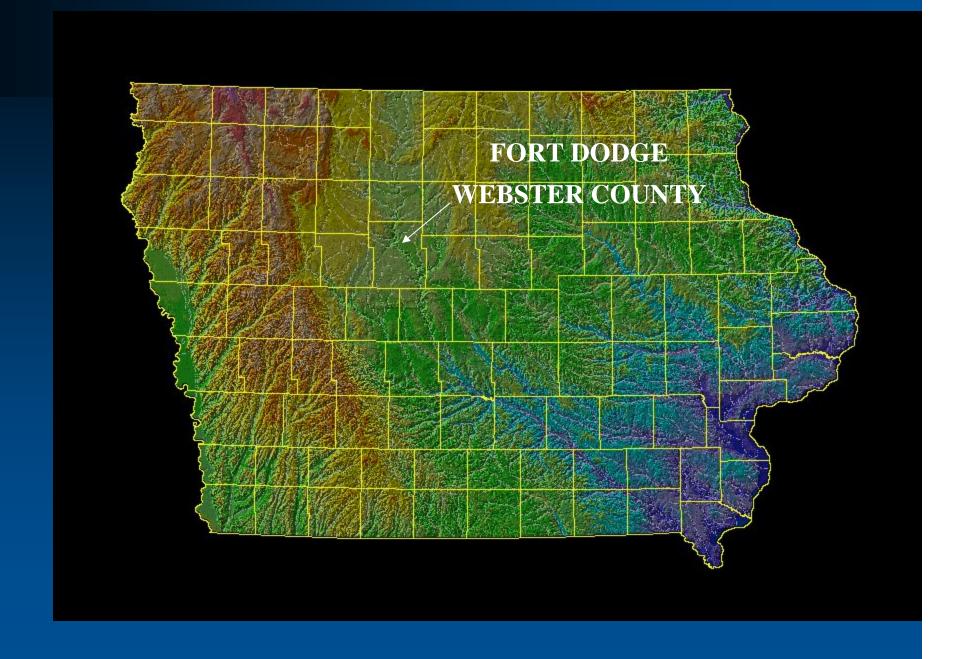
SUBSIDENCE MANAGEMENT AT NEW MINERAL CITY MINE FORT DODGE, IOWA

UNITED STATES GYPSUM COMPANY

Joseph Crawford - Chicago Jon Blazic – Fort Dodge, IA Matt Benzie – Fort Dodge, IA Kelvin Price – Plasterco, VA



Plant Location Sec 34 T88N R8W



FORT DODGE SUBSIDENCE PROJECT

- SUBSIDENCE HISTORY
- GEOLOGICAL CHARACTERIZATION
- RISK ASSESSMENT
- REMEDIATION / MONITORING SUBSITES (4)
- TECHNOLOGY
- RESULTS

USG New Mineral City Mine (Inactive)

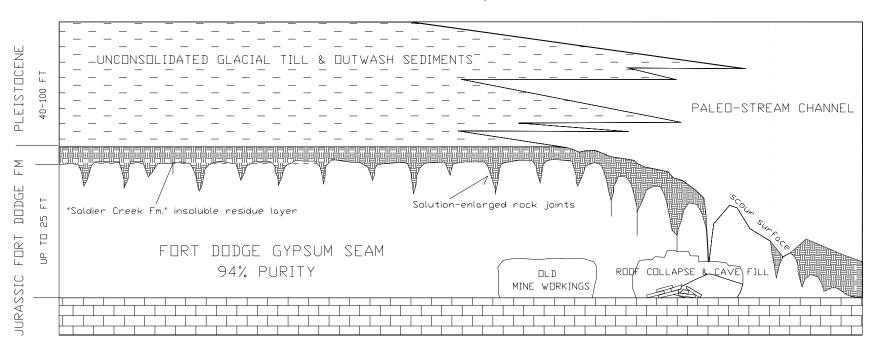
- Underground mining 1900-1927
- Workings 60-70 below surface accurate mine maps
- Gypsum mined room-and-pillar geometry
- Chimney sinks and troughs related to mine
- Backfilling monitoring -- surveying 1989 to present
- January 12, 2002 subsidence event
- Four (4) sub-sites addressed in this paper

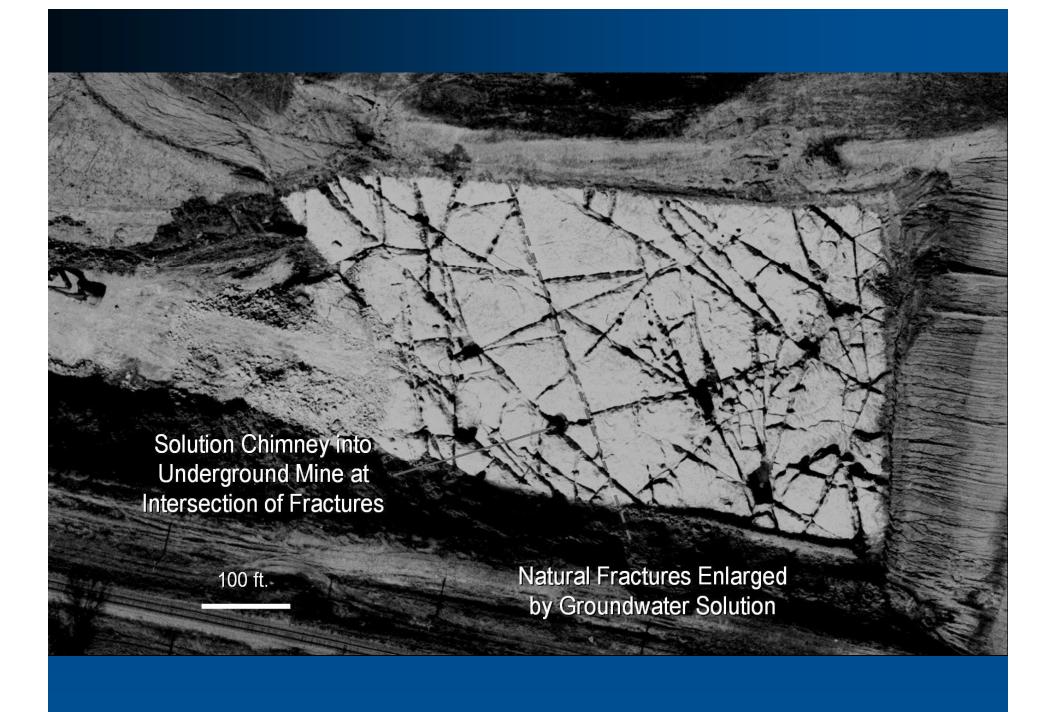


FORT DODGE SUBSIDENCE PROJECT

- SUBSIDENCE HISTORY
- GEOLOGICAL CHARACTERIZATION
- RISK ASSESSMENT
- REMEDIATION / MONITORING SUBSITES
- TECHNOLOGY
- RESULTS

SCHEMATIC GEOLOGICAL CROSS-SECTION OF GYPSUM DEPOSIT FORT DODGE, IOWA

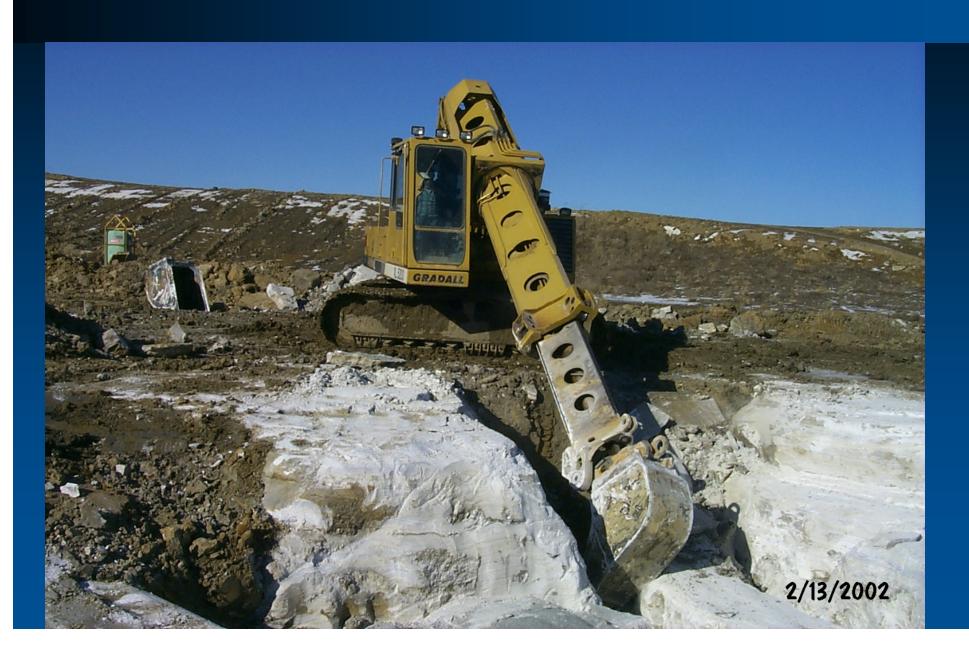


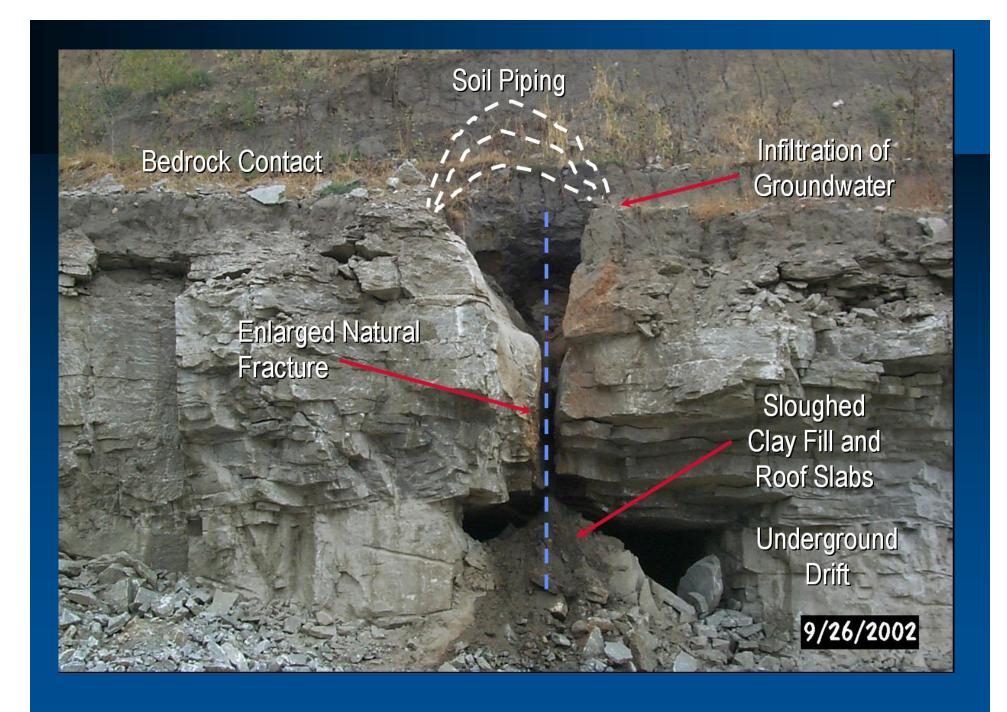


Fort Dodge FCU Operation



Fort Dodge FCU Operation





FORT DODGE SUBSIDENCE PROJECT

- SUBSIDENCE HISTORY
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- RESULTS

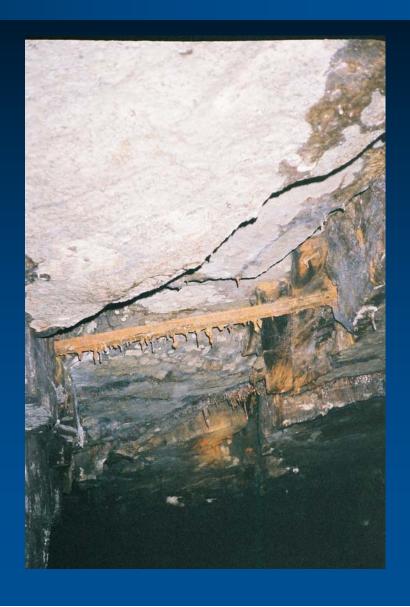
RISK ASSESSMENT

- Event Potential
- Impact of event on people / assets / property
- Composite risk value



Event Potential – Risk Factors

- High extraction ratios
- Mine roof conditions
- Mine level mud flows
- Poor surface drainage
- History of subsidence



Impact Categories

- Manufacturing and transportation assets / property
- Plant traffic areas
- Public Assets
- Public traffic volume (A.D.T.)

FORT DODGE SUBSIDENCE PROJECT

- SUBSIDENCE HISTORY
- GEOLOGICAL CHARACTERIZATION
- RISK ASSESSMENT
- REMEDIATION / MONITORING SUBSITES
- TECHNOLOGY
- RESULTS

Plant Sub-sites

Employee Parking Lot per Warehouse and Plant Road

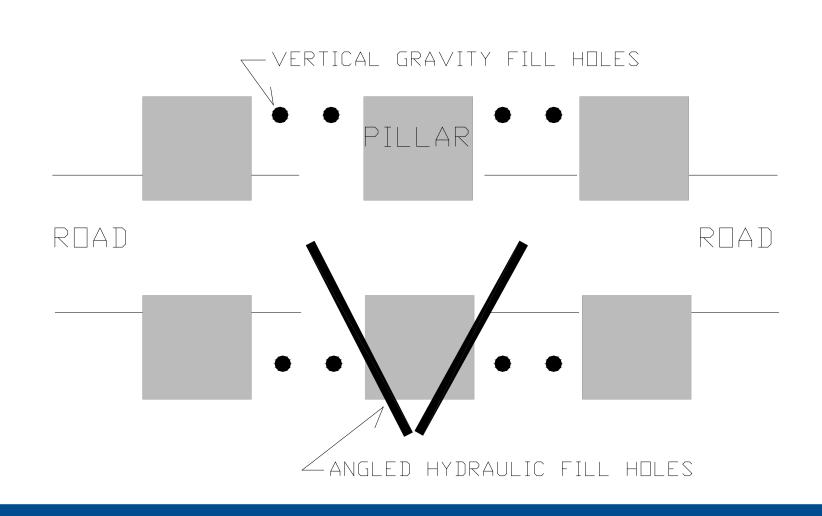
High-speed Railroad and Natural Gas Pipeline

FORT DODGE SUBSIDENCE PROJECT

- SUBSIDENCE HISTORY
- GEOLOGICAL CHARACTERIZATION
- RISK ASSESSMENT
- REMEDIATION / MONITORING SUBSITES
- TECHNOLOGY
- RESULTS

REMEDIATION AND MONITORING TECHNOLOGY

- Backfilling mined voids
 - Paper warehouse
 - CN / IC Railroad
 - Mill Road
- Monitoring
 - Borehole video camera (all sites)
 - TDR (Paper warehouse, Employee parking)
 - Daily inspection (digital camera, reports)





Hydraulic backfill stowage system



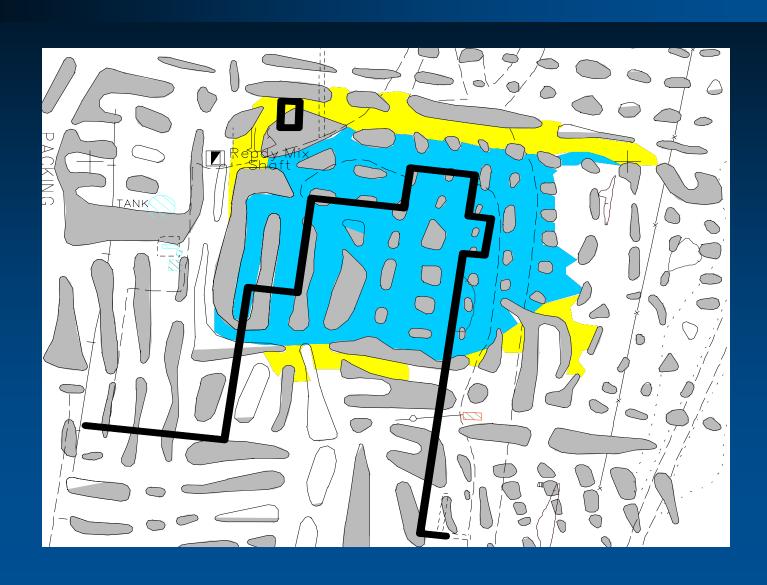


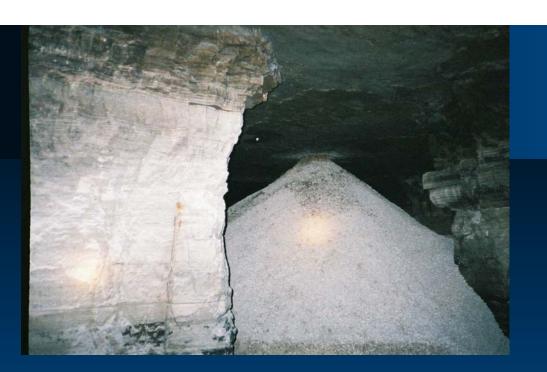


FORT DODGE SUBSIDENCE PROJECT

- SUBSIDENCE HISTORY
- GEOLOGICAL CHARACTERIZATION
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- RESULTS

PAPER WAREHOUSE FACILITY



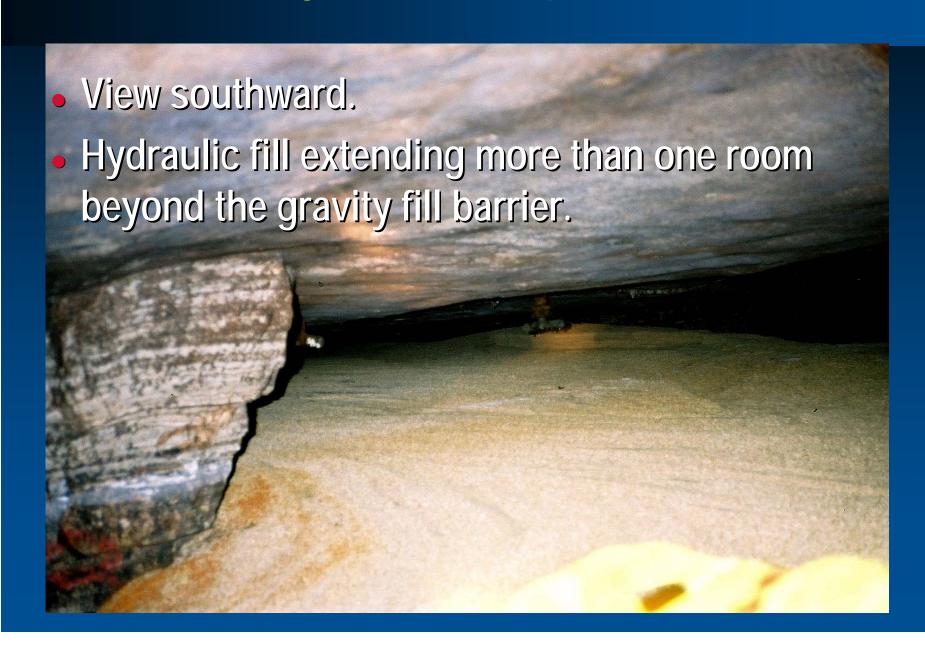


P4-4 South East Corner of Paper Warehouse - Before Hydraulic Fill Operations 2002

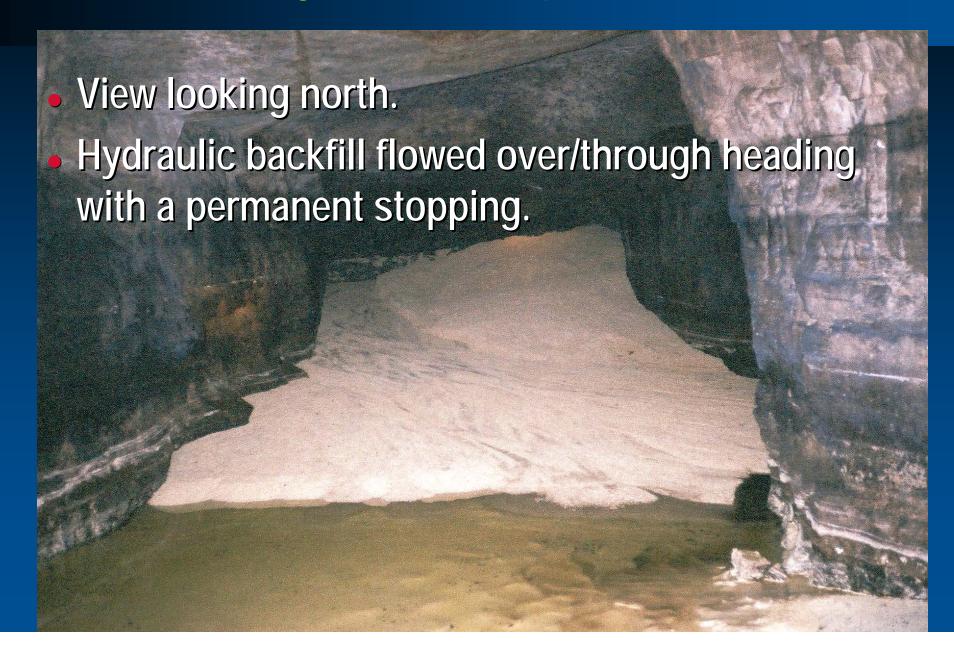
P30-4 South East Corner of Paper Warehouse - During Hydraulic Fill Operations 2003



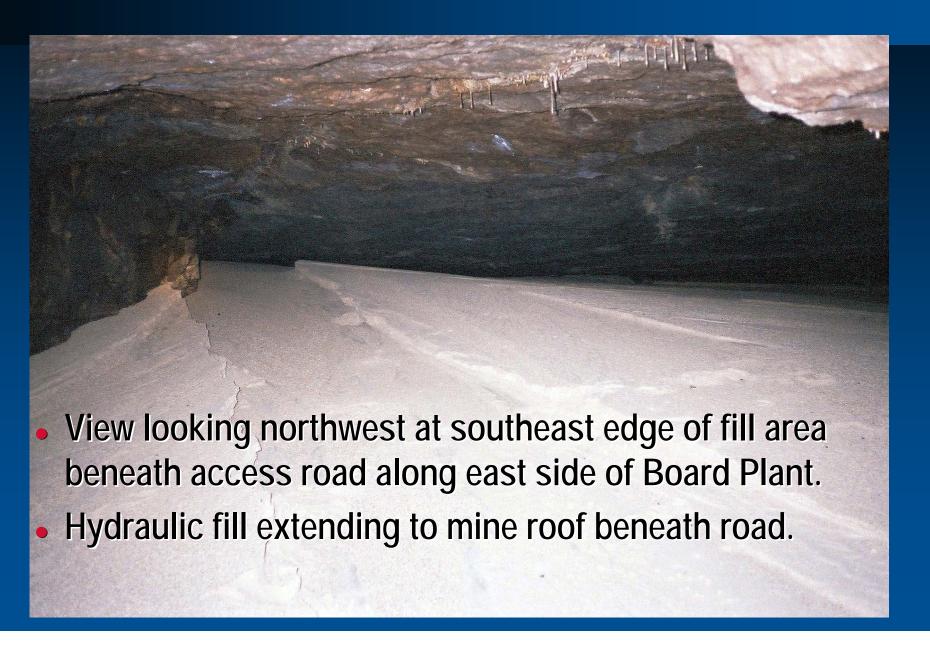
Backfilling - Phase I - Paper Warehouse

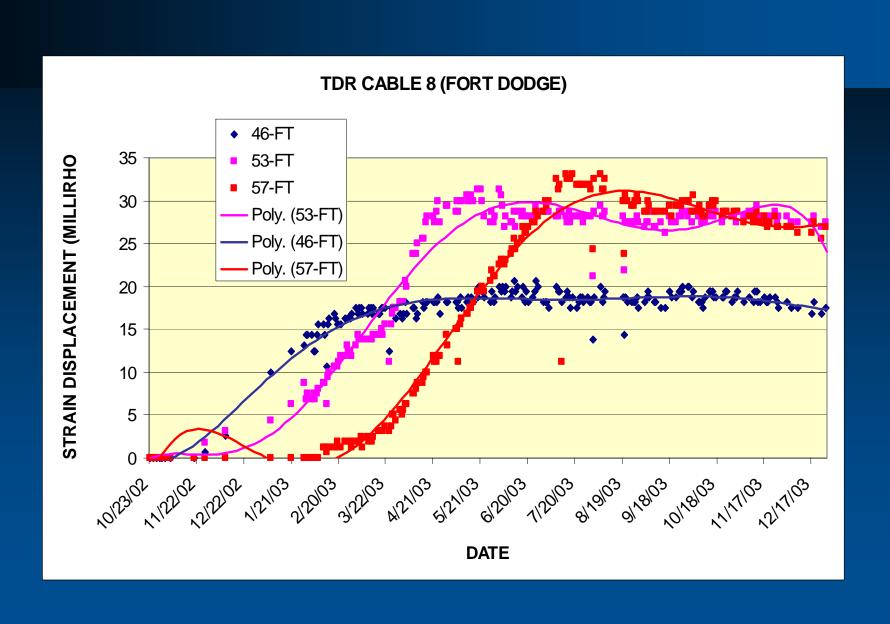


Backfilling - Phase I - Paper Warehouse

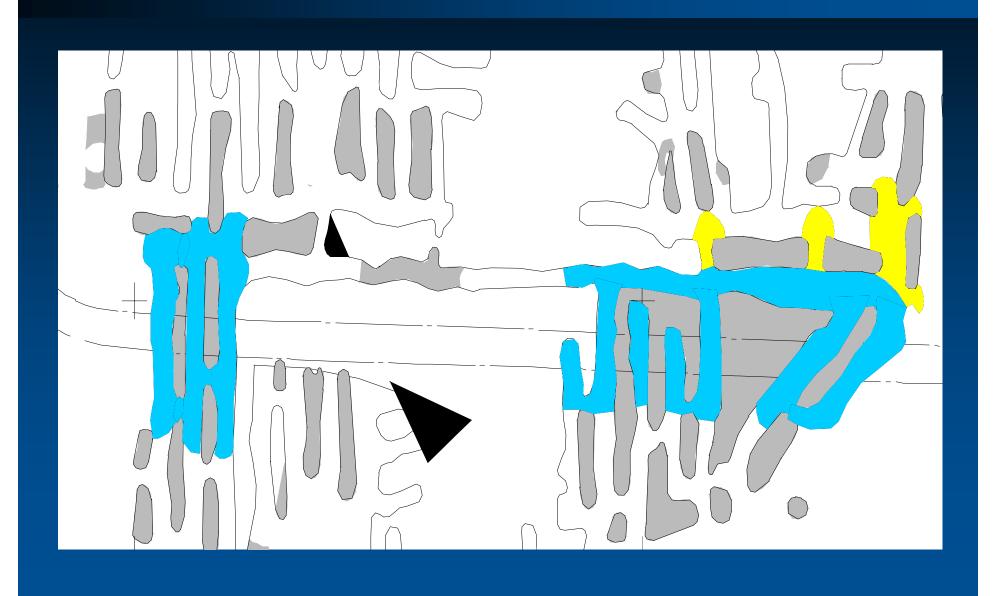


Backfilling - Phase I - Paper Warehouse





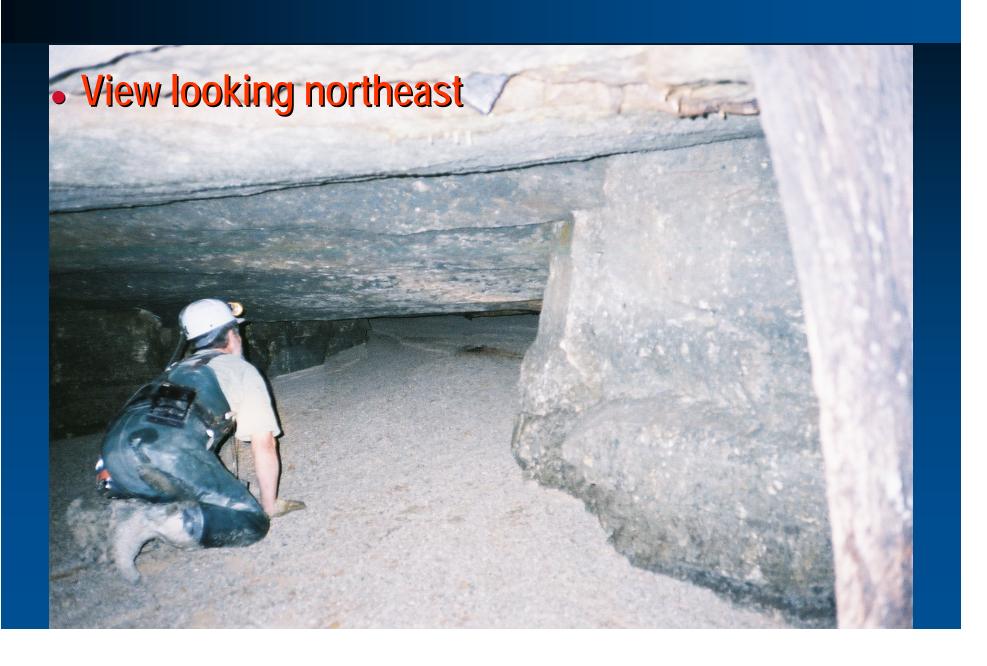
MILL ROAD (WEBSTER CO. PUBLIC ROAD) A.D.T. = 2,500



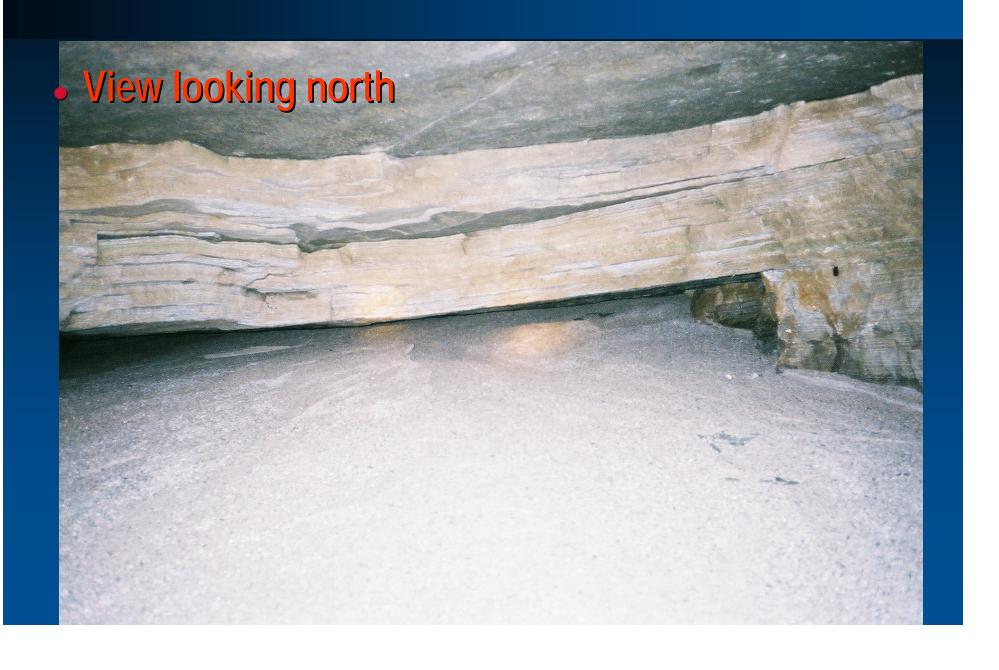
P30-2 Looking East from same Location



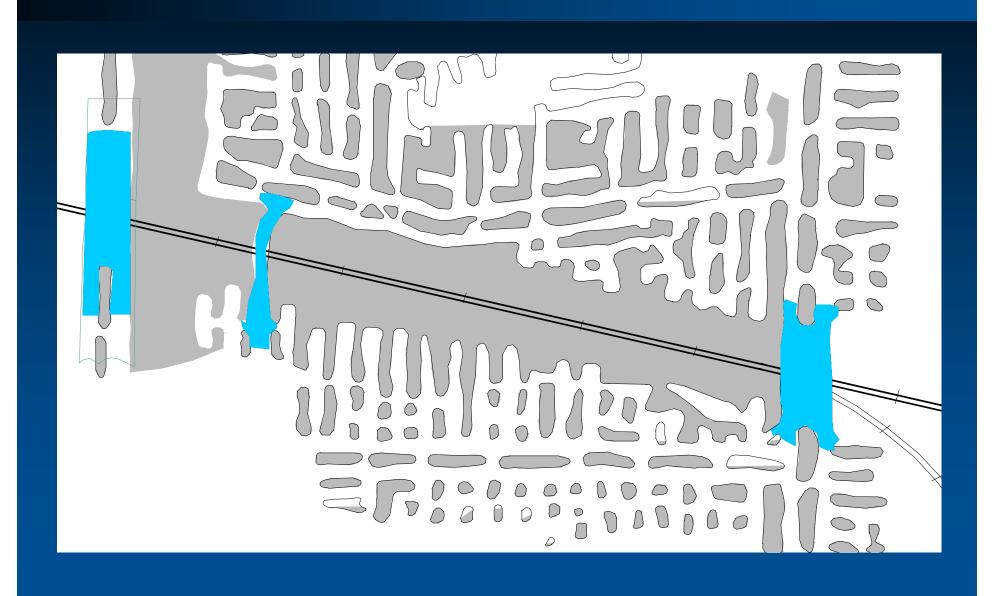
Results - Mill Road



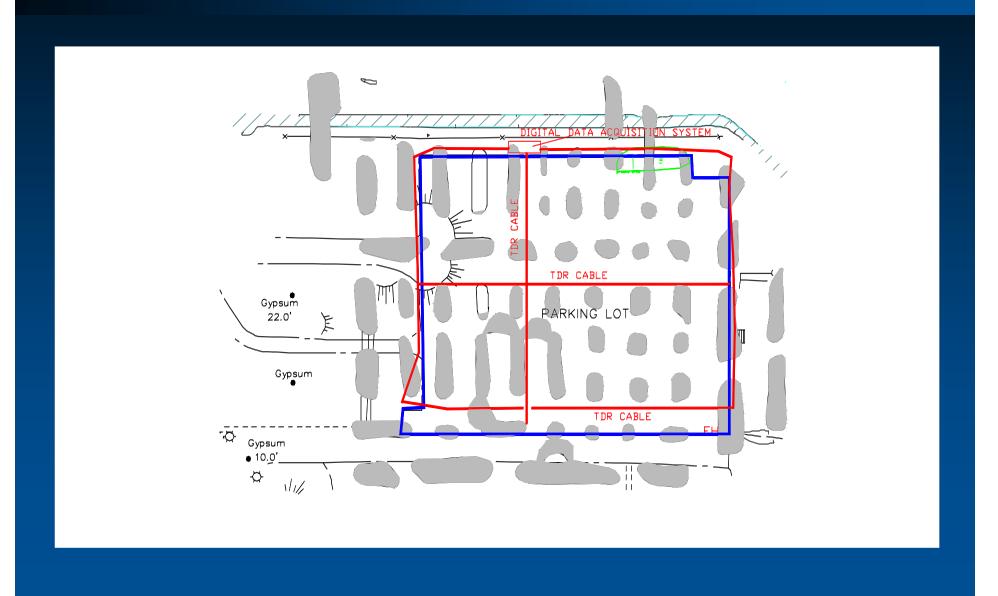
Results - Mill Road



CANADIAN NAT'L / ILLINOIS CENTRAL R.R.



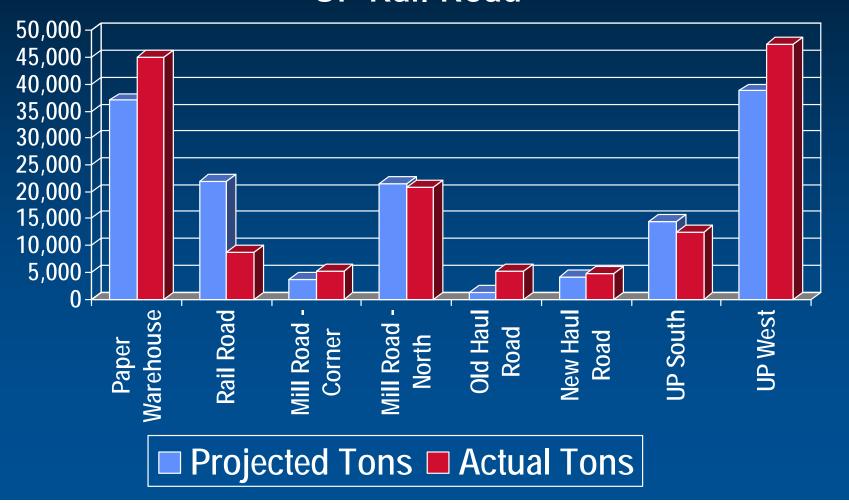
EMPLOYEE PARKING LOT



	Paper Warehouse	CN/IC Railroad	Mill Road
Days for backfilling	120	52	83
Tons gravity fill	7,034	2,860	8,140
Tons hydraulic fill	45,039	8,784	25,978
Quantity gravity fill holes	42	17	38
Quantity hydraulic fill holes	27	5	16
Actual / predicted tons ratio	1.22	0.4	0.98

Tonnage Progress Summary

Paper Warehouse - Rail Road - Mill Road - Haul Road - UP Rail Road



General Activity Costs

Automated TDR \$30,000

Vertical hole \$1,500

Angled core hole \$3,000

Gravity fill / t \$9.25

Hydraulic fill / t \$12.96

